REMARKS

This amendment is filed in response to the Office Action dated August 13, 2003. This application should be allowed and the case passed to issue.

No new matter is introduced by this amendment. The amendment to claim 1 is supported in the specification at page 3, line 36 to page 4, line 8; page 5, line 36 to page 6, line 4; and lines 19-20. The amendments to claims 2 and 3 merely correct informalities, and do not change the scope of these claims. The Amendments to the specification merely correct informalities.

Claims 1-15 are pending in this application. Claims 6-15 are withdrawn pursuant to a restriction requirement. Claims 1-3 and 5 are rejected. Claim 4 is objected to.

Restriction Requirement

Applicants appreciate the Examiner's alertness and thorough consideration of this application. In particular, Applicants thank the Examiner for noticing the typographical error in Applicants' election. As correctly noted by the Examiner, Applicants intended to elect Nd for Ln.

Drawings

The Examiner objected to the drawings because they include Reference sign 1, which does not appear to be in the specification, and because Fig. 5 should not be a Figure. This objection is traversed, and reconsideration and withdrawal respectfully requested.

The specification has been amended to specify that SOFC is Reference number 1. In addition, Figure 5 has been deleted and is now incorporated into the specification as Table 1.

Specification

The Examiner objected to the use of "$t^m o$" on page 3, and to the statement on page 3, lines 30-31 concerning formula (f-5). This objection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The specification has been amended so that "$t^m o$" is now "$t^m o$-". As regards formula (f-5), the statement on lines 30-31 of page 3 of the specification is correct. The term "$t^m o$-" is the first member of the equation and is also in the denominator on the right hand side of the minus sign. Thus as the value of $t^m o$- increases the value of the terms on the left hand side of the minus sign increases, and the value of the terms on right hand side of the minus sign decreases ($t^m o$- is in the denominator on the right hand side of the minus sign). Therefore, a number that is increased in value is subtracting a number that is decreased in value. Therefore, the net $E^m(J)$ increases as $t^m o$- increases, and the more output power of the SOFC is taken.

Claim Rejections Under 35 U.S.C. § 102

Claims 1-3 and 5 were rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Soral et al. (*Comparison of Power Densities and Chemical Potential Variation in Solid Oxide Fuel Cells with Multilayer and Single-Layer Oxide Electrolytes*).

Claims 1-3 and 5 were rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Miyashita et al. (U.S. Patent No. 5,731,097).

These rejections are traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the invention as claimed and the cited prior art.

An aspect of the invention, per claim 1, is a solid oxide fuel cell comprising a first perovskite solid electrolyte layer exhibiting mixed conductivity and having oxygen ion conduction as main conduction under operational condition of the solid oxide fuel cell. A fuel electrode is provided on one surface of the first solid electrolyte layer and an air electrode is provided on the opposite side of the first solid electrolyte layer. A second solid electrolyte layer is provided between the first solid electrolyte layer and the air electrode. The second electrode has a lower ratio of conduction by holes and higher ratio of conduction by oxygen ions of the conductive carriers of electrolyte such as ions, electrons, and holes than that of the first solid electrolyte layer under the operational condition of the solid oxide fuel cell.

The Examiner asserts that Soral et al. and Miyashita et al. disclose the claimed solid oxide fuel cell.

Soral et al. and Miyashita et al., however, do not disclose the claimed solid oxide fuel cell. Soral et al. do not disclose a **perovskite** solid electrolyte layer, as required by claim 1. Soral et al. disclose the following multi-layer structures of SOFC in column 2:

1) cathode/ YZTb:0.2μm/ GDC:100μm/ YSZ:2μm/ YDC:0.2μm /anode;

2) cathode/ YZTb:0.2μm/ GDC:10μm/ YSZ:2μm/ YDC:0.2μm /anode;

3) cathode/ GDC:100μm/ YSZ:2μm/ anode: and

4) cathode/ GDC:10μm/ YSZ:2μm/ anode; wherein

YZTb is terbia-doped YSZ, GDC is gadolinia-doped ceria; and YDC is

Yttria-doped ceria.

Soral et al. disclose YSZ and ceria based materials as the solid electrolyte layer. However, the YSZ and ceria based materials have a fluorite face-centered cubic crystal structure. YZTb, GDC, and YDC do not have a perovskite structure, as required by claim 1.

Miyashita et al. disclose a solid oxide fuel cell consisting of "cathode / YSZ / ceria based electrolyte / anode" in column 5, lines 12-25. However, the YSZ and ceria based solid electrolytes are not a perovskite solid electrolyte layer, as required by claim 1. Miyashita et al. also disclose a solid oxide fuel cell consisting of "cathode / YSZ / LSM / anode" in column 6, lines 23-48. While, LSM is a perovskite solid electrolyte material with mixed conductivity, LSM has an electron conduction which is much stronger than oxygen ion conduction under operational condition of the SOFC, therefore the oxide ion transport number of LSM is very low. Generally, a solid electrolyte is required to transport oxygen ions. While LSM can be employed as an air electrode, it is not suitable for use as a solid electrolyte material because of its low oxide ion transport number. Therefore, Miyashita et al. do not disclose a solid electrolyte layer exhibiting mixed conductivity and having oxygen ion conduction as main conduction under operational condition of the solid oxide fuel cell, as required by claim 1.

The factual determination of lack of novelty under 35 U.S.C. § 102 requires the disclosure in a single reference of each element of a claimed invention. *Helifix Ltd. v. Blok-Lok Ltd.*, 208 F.3d 1339, 54 USPQ2d 1299 (Fed. Cir. 2000); *Electro Medical Systems S.A. v. Cooper Life Sciences, Inc.*, 34 F.3d 1048, 32 USPQ2d 1017 (Fed. Cir. 1994); *Hoover Group, Inc. v. Custom Metalcraft, Inc.*, 66 F.3d 399, 36 USPQ2d 1101

(Fed. Cir. 1995); *Minnesota Mining & Manufacturing Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 24 USPQ2d 1321 (Fed. Cir. 1992); *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051 (Fed. Cir. 1987). Because Soral et al. do not disclose the perovskite solid electrolyte layer and Miyashita et al. do not disclose the perovskite electrolyte layer having oxygen ion conduction as main conduction under operation condition of the solid oxide fuel cell, as required by claim 1, Soral et al. and Miyashita et al. do not anticipate claim1.

Applicants further submit that neither Soral et al. nor Miyashita et al. suggest the claimed solid oxide fuel cell with the claimed perovskite solid electrolyte layer and the oxide ion conductivity.

The dependent claims are further distinguishable over the cited references. For example, claim 2 further requires that the oxygen ion conductivity, oxygen ion transport number and a thickness of the first solid electrolyte layer are respectively σp, tpo and Lp; oxygen ion conductivity, oxygen ion transport number and a thickness of the second solid electrolyte layer are respectively σc, tco and Lc; and the following formula is satisfied: $Lp/(tpo \bullet \sigma p) > Lc/(tco \bullet \sigma c)$. Claim 3 further requires that tpo is an oxygen ion transport number of the first solid electrolyte layer; σc, Lc and tco are respectively total conductivity, a thickness and an oxygen ion transport number of the second electrolyte layer; J, E0 are respectively a load electric current density and theoretical value of OCV of the solid oxide fuel cell, and the following formula satisfied: $J \bullet Lc/(tco \bullet \sigma c) < (tco - tpo) \bullet E0$. Claim 5 further requires that the second solid electrolyte layer is made of stabilized zirconia, or alternatively a ceria based oxide. The cited references do not suggest the claimed solid oxide fuel cell with these additional limitations.

Allowable Subject Matter

Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Applicants gratefully acknowledge the indication of allowable subject matter. However, because Applicants believe that independent claim 1 is allowable for the reasons explained above, Applicants do not believe it is necessary to rewrite claim 4 in independent form.

In light of the Remarks above, this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT, WILL & EMERY
Bernard P. Codd
Bernard P. Codd
Registration No. 46,429

600 13th Street, N.W.
Washington, DC 20005-3096
(202) 756-8000 BPC:BPC
Facsimile: (202) 756-8087
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